Western Kansas Lego Robotics Competition

April 7, 2014

Fort Hays State University

WELCOME

FHSU is hosting our 9th annual Lego robotics competition. The competition is open to all area middle school students (grades 5-8).

This event will be held at the campus of Fort Hays State University on Monday April 7, 2014. The event will start at 10:00 a.m. (registration begins at 9:00 a.m.) in the Ballroom of the Memorial Union. Parking permits will be supplied to teachers at check-in. The event will end at 3:00 p.m. after the award ceremony.
OVERVIEW

Each team of students will compete in at least one event and up to as many as they wish (there will be a total of 5 events). A team may consist of 1-5 members. Multiple teams from one school are permitted.

Each competing robot must be constructed solely from parts found in a single standard Lego robot kit: either NXT, or NXT 2.0, or EV3 (retail or educational) kits may be used. Also, all events but one require that the robots be autonomous (i.e. Bluetooth, infrared, or wired remote control is only allowed for the “Number Crunching” event). Teams with robots found to be in violation of the rules will be disqualified. If competition courses are set up outside of the main event areas, teams may use them for practicing. However, teams may not practice on courses set up in the competition area unless given permission by the judges. Remember, due to time constraints this is purely a competition event. Students are expected to have fully working programs upon arrival.

It is expected that all robots will be programmed to begin competing at the press of the center orange (NXT) or center grey (EV3) button. Calibrations of sensors (e.g. black/white light/color sensor intensity calibrations) will be allowed (and is encouraged). The contest will begin upon the final pressing of the orange/grey button (sometimes a delay between pressing the button and robot motion will be required—see the Sumo bot event!). Teams will get only two chances to successfully start their robot. This means that if the wrong program is started by accident the team can tell the judges and have one more chance to start their robot. Note that teams must use their “second chance” immediately; no additional programming can be done once the team has been called to compete. It is not required for the robot to automatically stop at the completion of an event unless otherwise specified; when the judges have finished they will indicate that the robot can be picked up and deactivated.

Awards will be given for 1st, 2nd, & 3rd places in each event, as well as an overall traveling trophy for the team that acquires the largest number of total points. Points will be awarded for the top-five ranked teams: 1 pt for 5th place, 2 pts for 4th place, 3 pts for 3rd place, 4 points for 2nd place, and 5 pts for 1st place. Exception: only the top 4 teams will be awarded points in the Sumo Bot event. No points will be awarded to teams who place below the top five in each event. The overall event trophy will be awarded based on the sum of the scores awarded in the five main events: Line Follower, Counting Colors, Maze Madness, Number Crunching, and Sumo Bots. Ties for the overall event trophy will be broken by referring to the “prestige factor” of the relevant events. The most prestigious event is Counting Colors, followed by the Sumo Bots, Number Crunching, Maze Madness, and Line Follower events, in that order. Therefore if two teams have an identical summed score, their relative scores in the Counting Colors event will be used to break the tie. If one or both of the teams did not participate in the Counting Colors event, their relative scores in the Sumo Bots event will be used to break the tie, etc. If the teams did not compete in any overlapping events, then the team which competed in a more prestigious event will win the overall trophy.

Any eventualities which arise that are not discussed herein will be decided by the event’s final arbiter.
EVENTS

1) Line Follower

This event is a line-following race. The goal is to follow a black track (0.75” wide black electrical tape placed on a white board) as rapidly as possible. Robots must leave the start area, traverse the line course, turn around at the dead end, and follow the line back to finish at the start area. Robots must follow the line; lost/wandering robots will be disqualified (turning around at the half-way dead end mark is permitted and not counted as “wandering” off the line). Teams may only use one sensor (light or color) and will have time to calibrate it if they wish before the start. An example line following course is depicted at the right. The robot that traverses the course in the least amount of time will be awarded first place. Point scores for the first five teams will be given; 1st place (quickest robot) gets 5 points, 2nd place gets 4 points, etc.

2) Counting Colors

A color sensor will be used to detect the colors of M&M’s chocolate candies (oblate spheroid shapes). Brown, blue, green, yellow, and red M&M candies will be used (no orange). White paper (letter size) will be placed near the edge of a wooden box (same box as used in the Number Crunching event). The center of the candies will be placed on the paper exactly 4.25” (10.8 cm) away (half-way on the paper) from the inside edge of the wooden box. The robot is allowed to touch the box edge with a special wheel or pulley to help with straight line guidance. Ten M&Ms of random color will be placed approximately 5.5 cm apart along an imaginary line 4.5” away from the edge. There will be no M&M’s placed along the first or last 12” of this line. The robots will be started so that their front-most part is 10” away from the back edge of the box. They will then be started and drive along the row of candies. The robot’s travel time will be recorded with a stop watch (from start of button press till it bumps the far box edge. A judge will then pick up the robot and examine its display. The display must clearly show the 5 colors and an associated count number for each color (see example below). The robot with the correct color counts and shortest travel time will win the event. Robots with incorrect color counts will not get any points. The students must place the robot at the start position before the colors are randomly chosen, and then they are only allowed to push the orange button to start. Point scores for the first five teams will be given; 1st place gets 5 points, 2nd place gets 4 points, etc.

| Brown | 01 |
| Blue  | 05 |
| Green | 02 |
| Yellow| 02 |
| Red   | 00 |

<Example robot display after counting the colors of 10 candies; in this example there happened to be 1 brown, 5 blue, 2 green, 2 yellow, and no red M&Ms.
3) Maze Madness

The goal of this event is to traverse a maze (with wooden walls) as quickly as possible. The physical characteristics of the maze are shown in the figure below. The event will be timed; each robot will be given a total of 3 minutes to solve the maze. The robot which transverses the maze from start to finish in the shortest amount of time wins. Bumping into the maze walls is permitted; they are sturdy and will not give way. Teams will position their robots at the start such that the back of the robot is within 1” of the wall. To finish, the robot must make physical contact with the final dead end wall (it does not have to stop; the judges will stop their stopwatches when they see contact). If a team’s robot does not reach the finish line before 3 minutes is up, it will be disqualified. Point scores for the first five teams will be given; 1st place (quickest robot) gets 5 points, 2nd place gets 4 points, etc.
4) Number Crunching

Four gaming dice (16 mm side length) will be used in this event. The dice will be placed in a wooden box (43.5” x 43.5”), and the center of each die will be placed 12” away from both box walls (see the figure below). Competitors will be allowed to control their robots wirelessly using Bluetooth or infrared signals, or with wires. Teams can use their laptops, cell phones, or another NXT brick (e.g. for laptop control try this software: http://www.monobrick.dk/software/remote/). The goal is to direct the robot to roll the dice such that they all show “1” (one dot on top face) as quickly as possible. The original orientation of the die will be the same for all competitors (see figure below). The event will be timed; each robot will be given a total of 3 minutes to roll all the dice. The robot will be started at the center of the box and the contestants can initially point the robot towards any direction they desire. It does not matter where the dice end up, as long as they all show a “1”. Teams are encouraged to design a die rolling attachment for their robot and are allowed to attach rubber bands to their robots for this event (to provide grip or act as tripwires, etc.). Point scores for the first five teams will be given; 1st place (fastest team to correctly orient all the dice) gets 5 points, 2nd place gets 4 points, etc.

<Initial dice orientation (not to scale).
5) Sumo Bots

Two robots (from opposing teams) will face off in an elimination style Sumo match! The robots must be autonomous (not externally controlled). The robots will be placed on a painted wood regular octagon (see figure below). The black area in the center is surrounded by a 4” wide white strip, or “danger zone”. Teams will probably want to make use of light (or light/color) sensors (for making sure the robot avoids the “danger zone”) and the ultrasonic sensor (for finding the enemy robot). The robots will start back to back (with 14” between them), and they must be programmed to start moving 5 seconds after pressing the orange button. Any robots starting before 5 seconds has elapsed will be disqualified! Robots can only be constructed with parts from one standard NXT kit (with the exception that up to two light/color sensors may be used). Robots with a mass greater than 907.2 g (weight of 2.000 lbs) will be disqualified; the robots will be massed before competing. The robot playing surface will be slightly elevated above the floor; the first robot to fall off the playing surface and touch the floor loses. If both robots are still on the mat after 2 minutes has passed, the robot with the smaller mass will advance. In the unlikely event that the robots have the same mass, a coin toss will determine which robot advances to the next match. Point scores for the top four teams will be given; (the losers of the semifinal round will face off to get 3rd and 4th place, while the final round will determine 1st and 2nd place). First place gets 5 points, 2nd place gets 4 points, etc.